

**** Recommendations for Unbiased Population Monitoring of Dusky Grouse in Montana**

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No rigorous state-wide monitoring programs currently exist for dusky grouse. Difficult-to-reach habitat and low probability of detection makes monitoring dusky grouse difficult. Our objectives were to evaluate sampling and analytical methods for producing annual unbiased estimates of average local abundance, as well as the effect of survey conditions and survey timing on the probability of detecting dusky grouse. We compared point counts vs transects, and route type (off-trail, trail, road). We evaluated and compared four analytical methods using simulations: time-to-detection model and N-mixture model for point counts, raw count (naïve) and hierarchical distance sampling model for point counts and transects. We found surveys located along roads/trails best balanced the trade-offs between sampling effort and survey design requirements, despite limiting inferences to dusky grouse populations located in prime habitat along roads/trails. Simulations indicated that N-mixture models where sites were visited four times resulted in unbiased estimates of local population size with the highest precision. Detection of dusky grouse was highest on clear days, with little wind and background noise, with surveys occurring 0-200 minutes post-sunrise during 5-20 May. Based on our preliminary results, we recommend conducting surveys along roads/trails at 240 sites under optimal conditions during May within 3.5 hours post-sunrise using electronic playback to increase detection. We recommend surveying each site four times and estimating population size using a N-mixture model. Our results provide baseline information necessary for the development of a state-wide monitoring program for Montana and illustrate a process applicable for developing dusky grouse monitoring elsewhere.